

The Builder.

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THE late dreadful accident at Yarmouth has led various correspondents to address us; some on the safety in general of bridges erected on the suspension principle,

some on the cause of this particular accident, and one on the apparent lightness and instability of the new Hungerford Bridge. We have before us various statements, too, for and against Dredge's principle, and a notice of Andrew Smith's suspension and parabolic tension bridge, which does not require piers.

"A fatality seems to attend chain bridges," says one writer, "even when the most eminent engineers erect them. At Paris, two attempts failed a few years since, through, I fear (good mathematicians as our neighbours are), some omissions in the formula. The Montrose suspension bridge partially gave way at the opening some years ago; and at the time, I was told, several individuals were impaled on the iron-work for hours, before tackle could be brought to bear to relieve them. Since that, both it and the Menai have been injured by storms; and I must say, from what little consideration I have been able to give to the subject, as a mechanic of the humbler class, I do not think suspension bridges are built strong enough or sufficiently braced."

The Broughton suspension bridge at Manchester broke under a body of only sixty soldiers passing over in marching order,—the simultaneous tread of the feet having the effect of a series of heavy blows.

One of Mr. Dredge's bridges in the Regent's Park is understood to have fallen with only a dozen boys on it; and others are said now to be in a state of dilapidation, if not danger. We have no wish, however, to be alarmists, and to raise fears which may not be so easily quieted. Still, feeling that calculations are not to be entirely relied on in these cases; that much depends on the goodness of workmanship which *has not been tested*; and that the mere fact that a suspension bridge has carried heavy loads nineteen times is no reason why it should not break down the twentieth,—we are impelled to urge the necessity of constant examinations by efficient persons. "From the rapid advances which have, of late years, been made in the sciences," says a writer in the *Mining Journal*, "and their application to the arts, we have discovered that iron undergoes most important changes under various circumstances—such as continual percussion, electricity, galvanic action, &c.—and I think it becomes a subject of deep interest, and one which ought to be most searchingly investigated, whether these agents, or any of them, have contributed to produce the effects in question; and the public must be informed whether any, and what, examination of the chains, suspension rods, &c., takes place in these erections, and how often; for, be it remembered that, while a stone structure gives token of decay, and openly exhibits to the eye any danger or necessity of repairs, one corroded bul in a suspension bridge—one portion of iron, which, though having stood the proof before being used, may, from some of the above-named causes, have become chemically altered—

may at once, unnoticed, and without the slightest warning, be the cause of irreparable mischief."

The jury who investigated the late melancholy catastrophe at Yarmouth are much to be commended for the determination they evinced to have the cause of the accident examined into by a scientific engineer. When the town-council refused to furnish them with such assistance they addressed a memorial to the Secretary of State, setting forth:—"That in consequence of the excitement which exists in the town and neighbourhood, and of numerous reports in circulation as to the state of the bridge, your memorialists considered it absolutely necessary that they should have the evidence of some scientific practical engineer, in order to enable them to arrive at a just and proper conclusion; but the coroner having no power to pay the expenses which would be incurred by the employment of such engineer, your memorialists addressed a representation of the circumstances to the town-council of the said borough, requesting that body to authorize the employment of an engineer for the purpose before mentioned. That your memorialists have received a formal communication from the town-clerk of the said borough, stating that the town-council, at a meeting held on the 8th inst., had declined to comply with your memorialists' request, feeling that it was not in their province to do so. That your memorialists are still of opinion that the evidence of an engineer in their investigation is imperatively called for; because they not only know that it would be satisfactory to themselves and to the public, but they also believe that the publicity which would be given to his evidence might be the means of preventing the recurrence of so frightful a catastrophe:"—and praying that he would direct some civil engineer to attend on the spot.

Mr. Walker was accordingly sent down, and there can be no doubt that much good will result from the clear and able statement which he made after his survey. This statement involves several questions of great importance, and we deem it desirable to transfer it to our pages nearly entire; the more so, too, as it gives a history of the bridge, and the addition that was made to it.

"The bridge belonged," said Mr. Walker, "to the late Mr. Cory, father of the present owners, and was constructed from a design of Mr. Scoles, an architect in London. At first it was only a substitute for a ferry over the river Bute to the marshes, and to certain pleasure grounds called Vauxhall-gardens, belonging to Mr. Cory. Mr. Scoles, who has attended from London on this occasion, and who has assisted me very liberally with his drawings and calculations, states, that he made designs for a bridge of sufficient width for a carriage and two footways. The design was made from memory of the particulars given to him by Mr. Cory, but I understand that he never was at Yarmouth until the day before the bridge was opened; that these drawings were given to Mr. Green, a surveyor at Yarmouth, who was at that time employed here, and who was well known in this district. Mr. Scoles thinks Mr. Cory had at that time in view the making of a new turnpike-road from Yarmouth to Acle, which-road, which was to pass over the bridge, although Mr. Cory at that time did not so inform him. It appears that the work was offered for competition, and that Mr. Goddard was the contractor (who is since dead) for the bridge work, according to specifications prepared by Mr. Green, the surveyor I before referred to. These specifications were embodied in the contract, which contract I have seen, but which does not give the size of the principal parts, although it refers to drawings which it states are attached to the contract, but which are not, nor have I been able to see them. It appears that they are either mislaid or lost. The specifications describe that the iron shall be of the best quality. The speci-

cation describes it as the best charcoal iron. Now, this is a description of which very little is made in this country; the meaning of the term is, that it was to be British iron of the very best quality. The specifications make no mention as to the quality of the iron being tested, as far as I have observed. From a drawing which is now in Mr. Scoles's possession there appears no reason to doubt that the main or suspending chains and other parts of the bridge are of the size which was intended. The drawing which I have in my hand is executed in a very excellent and workmanlike manner. There are altogether four suspending bars, two on each side, to form a chain. The bars are connected together by bolts passing through openings or eyes at each end of them. These bars are 2½ inches wide by seven-eighths thick; from them rods of 1 inch square were suspended to carry the roadway, which was 14 feet 9 inches in width, and divided by an iron kerb or carriage-way from a footpath on each side 4 feet in width. The length between the centre of the towers is 92 feet; the deflecting of the chains is 7 feet 4 inches. An Act of Parliament, constituting the bridge a turnpike-road, was passed in May, 1830, and the road was opened in 1832; in 1842 the Yarmouth and Norwich Railway Act was passed, which contains a clause, obtained, as I understand, after much litigation and opposition, by which this bridge was constituted the only communication between the railway station and the terminus, Mr. Cory agreeing to receive the tolls, stipulating to widen it and afterwards to expend it. It appears that on this occasion Mr. Scoles was again consulted respecting the widening of the carriage-way to a width sufficient for two carriages to pass abreast—the footway being formed on each side by planks separated by iron straps attached to the framing of the bridge. This footway was therefore outside the suspending chains. That was in 1844. Mr. Cory says, that after the above alterations were made, he consulted an eminent engineer as to the sufficiency of the bridge, who said that it was fit for any traffic. I cannot help observing on this, that any opinion taken from an engineer, however eminent, in an off-hand manner, is what the engineer would not consider himself bound by, and which I should think it very unfair to impute him in; because sometimes a gentleman is asked a question in an off-hand manner, and either from a feeling of politeness, or a desire to get rid of it altogether, he answers in a favourable manner; much more so than he would if he had an opportunity of examining it. The foundations appear to have been piled well, and to have stood well. Mr. Scoles showed me a drawing of the piling, and, if the work were executed according to that, I have very little doubt of the soundness of the foundation. You are probably aware that I am very well acquainted with the foundations of this part of the country, having been consulting engineer to the Haven and Pier Commissioners for many years. I have also made drawings for a fixed bridge over the Yare, and I erected the temporary bridge which is now there. It is stated that the crowd collected on the 2nd of May was confined to the south side; that the crowd was composed chiefly of children in the front rank, with adults behind, to see some exhibition which was then to be seen on the water. They were supposed to be four or five deep, and it appears that they had collected on the bridge to the number of from 300 to 500. The coroner has stated to me that he has seen double the number on the bridge (or even more than that), but that on those occasions they were spread over on both sides of the bridge, so that all four bars or two chains were equally loaded. It has been stated, I believe, by one of the witnesses who has been examined before, that some sort of cracking noise was heard, which induced him to look up, when he saw that one of the bars or rods of the suspending-chain was broken—that two points where the fracture had taken place were entirely separated, and that in about five minutes afterwards came the fatal catastrophe. This cracking was no doubt occasioned by the snapping in pieces of the bar which first gave way. There was now only one bar left to support the whole weight, and this bar consequently gave way in five minutes after the one on the opposite side; the platform, being then entirely unsupported, fell in the river. 1